

A Study of the Seasonal Foods
of the Black Francolin¹ [*Francolinus
francolinus* (Linnaeus)], the Grey
Francolin¹ [*F. pondicerianus* (Gmelin)],
and the Common Sandgrouse
(*Pterocles exustus* Temminck)
in India and Pakistan

BY

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The conservation and wise use of our natural resources is important to everyone. The value of good soil, adequate water, and abundant forests to the country, although well known to the technical man, is just beginning to be understood by a small part of the general public. Only a handful of people appreciate the need for protecting and maintaining our birds and mammals, especially the species that provide hunting and are used for food.

No plan for making our renewable natural resources more productive can succeed for long unless it is based on an adequate study of the factors that produce these resources. For example, with game species one must know not only how much hunting pressure they can take and still produce a good crop of game the following year, but also where they live, what they eat, how they are affected by floods and drought, and what are their natural enemies. Only when one has reliable information on these and other factors, can a well-thought-out plan be developed.

¹ The popular names in use in India and Pakistan for *F. francolinus* and *F. pondicerianus* are Black Partridge and Grey Partridge respectively. In this paper the authors have used the names Black Francolin and Grey Francolin in order to avoid confusion with certain other species existing in America and spoken of there as partridges.—EDS.

It was with this in mind that the authors made a study of the food habits of three species of game birds that are common in India and Pakistan. Except for C. W. Mason, an entomologist, who in 1912 reviewed the few references available and contributed an excellent list of insects found in the crops of Black Francolin, very little definite information is available. The other authors, listed in the references, either mention the food habits of the francolins and the sandgrouse in general terms or list one or two specific species which are commonly eaten.

The data here presented are based on an examination of the crop contents of 23 Black Francolin [*Francolinus francolinus* (Linnaeus)], 54 Grey Francolin [*Francolinus pondicerianus* (Gmelin)], and 47 Common Sandgrouse (*Pterocles exustus* Temminck). These birds were collected mostly in Sind (Pakistan) in 1956-57, and Rajasthan (India) in 1959-60, during the spring, summer, fall, and winter months. Though additional crops are desirable it is felt that the records so far obtained indicate the general food habits of the species involved and should be of beneficial use to the wildlife manager. Our hope is that this paper will, even in a modest way, stimulate additional studies which will lead towards a balanced game management programme for these species.

Since the collection of crops was made only as opportunity offered, the distribution of birds collected by seasons leaves room for further investigation. The seasons utilized were chosen after consultation with appropriate Government officials and local naturalists. In the areas concerned, spring and fall blend into summer and winter more quickly than in more temperate climates. Plants reflect these changes. Accordingly spring was designated as occurring between March 1-April 15; summer, April 16-September 15; fall, September 16-October 31; and winter, November 1-February 28. Based on this, the following is the distribution of birds collected by seasons :

Species	Number collected by seasons				
	Spring	Summer	Fall	Winter	Total
Black Francolin	5	8	1	9	23
Grey Francolin	0	28	7	19	54
Common Sandgrouse	6	14	11	16	47

Since no adequate collection of the seeds of wild plants was available for reference it was necessary to check many of the identifications by actually collecting the same seeds from wild plants in the countryside. In some cases the seeds taken from the crops of the birds were planted

first in pots and identified only after the resulting plant had grown to maturity. The identification of the insects eaten are given, in most cases, down to the order and family.

FOOD OF THE BLACK FRANCOLIN

All the Black Francolin examined were collected from Sind (West Pakistan). The study indicates clearly that this species is omnivorous. A total of 19 different genera of plants and 4 orders (including 12 species) of insects were found in the crops examined. In addition, one bird had eaten an earthworm, one a spider, two more had fed almost entirely on human excrement, and one, collected after a rainstorm, had swallowed an inch and a half toad. Of the 23 birds examined two had consumed insects only, 9 plants only, and 12 had eaten both.

Insects are eaten at all seasons of the year. Ants and beetles were commonly found in the crops, although wasps and flies were also identified. One bird, collected in August, had eaten 21 ants, 1 earthworm, 4 unidentified larvae, about 500 small pink midges, and a spider.¹

Plants, however, make up the bulk of the food of the Black Francolin throughout the year. Seeds of mustard (*Brassica campestris*), wild pea (*Lathyrus sativus*), cultivated grain, and grass seed were most commonly eaten. Parts of 20 different species of plants were identified which included seeds, fruits, tubers, grains, leaves, and a small amount of roughage in the form of twigs, husks, and dried grasses.

In winter the wild pea and the common mustard are favourite foods. One bird shot in February had made a meal of 250 wild peas; another, of over 300 mustard seeds with some leaves from the same species.

In spring, with the harvesting of the winter grains underway, the birds often turn their attention to wasted wheat (*Triticum vulgare*), barley (*Hordeum* sp.), and rice (*Oryza sativa*) whenever they are available, although other seeds are by no means avoided. One bird, collected in April, had scratched up and eaten 12 large tubers of a desert sedge (*Cyperus arenarius*) and others had fed largely on wild peas.

It is during the summer and fall, however, that the Black Francolin seeks out a great variety of plant foods. Most of those mentioned above were commonly found in the crops examined, but the largest number of seeds and inflorescences were from four genera of grasses that ripened at this time. One individual, collected in September, had a full crop of 1850 grass seeds representing four species, 250 seeds of Indian mallow (*Abutilon* sp.), one seed of *Rhynchosia* sp., and five other seeds, still unidentified. Another bird, shot in October, had consumed about 1000 seeds of *Setaria verticillata* and 54 seeds of three other grass species.

Table I gives the seasonal analysis of foods eaten.

¹ Grasshoppers were commonly found in the crops of Black Francolin collected by one of the authors in Iraq in 1951. Ticehurst, Buxton, & Cheesman (1922) record one crop that was crammed with the harmful locust *Decticus albifrons*.

TABLE I

Foods eaten by the Black Francolin according to Season and number of Crops in which each was found

Food	Parts eaten	Season			
		Spring	Summer	Fall	Winter
PLANT					
<i>Abutilon</i> sp. ..	Indian Mallow	Seeds	1		
<i>Brassica campestris</i> ..	Mustard	Seeds			2
<i>Cephalandra indica</i> ..	a cucurbit	Seeds	1		
<i>Cyperus arenarius</i> ..	Flat Sedge	Rhizome	1		
<i>Dactyloctenium aegyptium</i>	a grass	Seeds	1		
<i>Dactyloctenium scindicum</i> ..	a grass	Inflorescence	1		
		Seeds	1	1	
<i>Echinochloa colonum</i> ..	Jungle Rice	Peduncle		1	
		Seeds	2	1	
<i>Eriochloa procerata</i> ..	a wild millet	Inflorescence	2		
<i>Hordeum</i> sp. ..	a barley	Seeds	3		
<i>Lathyrus sativus</i> ..	Wild Pea	Seeds	1		7
<i>Lathyrus</i> sp. ..	a pea	Seeds	1		
<i>Launaea nudicaulis</i> ..	a compositae	Inflorescence			1
		Leaves			1
<i>Mukia scabrella</i> ..	a cucurbit	Fruits	2		
		Seeds	2		
<i>Oryza sativa</i> ..	Rice	Seeds	3	3	
<i>Panicum miliaceum</i> ..	Broom Corn	Seeds	1		
	Millet	Seeds	1		
<i>Pennisetum typhoideum</i> ..	Bajra, a millet	Seeds	1		
<i>Phaseolus mungo</i> ..	Pulse	Seeds	1		
<i>Rhynchosia</i> sp. ..	a legume	Seeds	1		
<i>Setaria verticillata</i> ..	Bristlegrass	Seeds	1	1	
<i>Solanum nigrum</i> ..	Black Nightshade	Fruit			1
<i>Triticum vulgare</i> ..	Wheat	Glumes	1		
		Leaves			1
		Seeds	2	1	
ANIMAL					
Hymenoptera ..		Small black ants	Whole	3	
		Medium black ants	Whole	5	1
		Large black ants	Whole	1	1
		Red ants	Whole	1	1
		Wasp	Whole	1	1
Diptera ..		Fly	Whole	1	
		Midge	Whole	1	
Coleoptera ..		Small black beetles	Whole	1	1
		Medium black beetles	Whole	1	
		Large black beetles	Whole	1	1
		Striped beetle	Whole		1
		Brown beetle	Whole	2	
Araneae ..		Spider	Whole	1	
<i>Pheretima</i> sp. ..	Earthworm	Piece	1		
<i>Bufo</i> sp. ..	Toad	Whole	1		
MISCELLANEOUS					
	Human excrement				2
	Grit				1

FOOD OF THE GREY FRANCOLIN

Of the 54 birds examined 38 were collected from western India and 16 from West Pakistan. Like the Black, the Grey Francolin is omnivorous. Of the crops examined 23 contained only plant material, one only insects, and in 30 both plant and animal items were found. From these, 33 species of plants and 7 orders of insects were identified. Miscellaneous items eaten included fragments of coal, baked bricks, grit, and snail shells. Animal material, other than insects, was limited to a few solifugids and spiders.

A great variety of weed seeds with some cultivated grain made up the bulk of the plant food. Members of the grass family are also well represented. Seeds were the prominent form of the plant food eaten. The variety and quantity of food taken is surprising. For example, one crop collected in upper Sind on February 26 contained 1 wheat seed (*Triticum vulgare*), 1 of wild melon (*Citrullus colocynthis*), 1500 of *Dactyloctenium scindicum*, 2000 of jungle rice (*Echinochloa colonum*), 4 of *Abutilon* sp., 5 of cockscomb (*Celosia* sp.), 1 unidentified seed, 1 green leaf, 1 large black beetle, 1 small beetle, and 2 termites. Another crop collected in Rajasthan in July contained green grass blades, hundreds of termite larvae (white ants), 6 cutworms, 18 tenebrionids, 3 carabids, 8 hydrophillids, 3 weevils, and grit.

Insect food was taken abundantly in the summer with the Grey Francolin showing a high preference for ants and termites. Interestingly enough beetles, some of which were of large size, comprised a substantial portion of the diet. In winter, where mustard is available, it is a favourite food.

The analysis of foods eaten in summer, fall, and winter is presented in Table II. No birds were collected in the short period represented by spring.

TABLE II
Foods eaten by the Grey Francolin according to Season and number of Crops in which each was found

Foods	Parts eaten	Season		
		Summer	Fall	Winter
PLANT				
<i>Abutilon</i> sp. ..	Indian Mallow	Seeds	1	2
<i>Acacia</i> sp. ..		Seeds	4	
<i>Brassica campestris</i> ..	Mustard	Flower buds		3
		Flowers		2
		Pods		1
		Seeds		2
		Leaves		4
<i>Capparis aphylla</i> ..		Seeds	9	4
<i>Celosia</i> sp. ..	Cockscomb	Seeds		4
<i>Cephalandra indica</i> ..	a cucurbit	Fruit skin	1	
		Seeds	1	

Food	Parts eaten	Season			
		Summer	Fall	Winter	
<i>Citrullus colocynthis</i> ..	Wild Watermelon	Seeds	2		1
<i>Cyperus rotundus</i> ..	Flat Sedge	Rhizome	1		
<i>Dactyloctenium aegyptium</i>	a grass	Seeds	1		
<i>Dactyloctenium scindicum</i>	a grass	Spikelets			1
		Seeds	1		4
<i>Echinochloa colonum</i> ..	Jungle Rice	Seeds	4		2
<i>Eragrostis minor</i> ..	a lovegrass	Seeds		3	
<i>Eriochloa procera</i> ..	a wild millet	Seeds	4		2
<i>Farsettia jacquemontii</i> ..	a cruciferae	Flower buds			3
		Pods			4
		Seeds	1		1
<i>Gynandropsis gynandra</i> ..		Seeds	3		2
<i>Indigofera</i> sp. ..	Indigo	Seeds			2
<i>Lathyrus sativus</i> ..	Wild Pea	Seeds			1
<i>Launaea nudicaulis</i> ..	a compositae	Inflorescence			3
		Leaves			1
<i>Mukia scabrella</i> ..	a cucurbit	Fruit skin	2		
		Seeds	2		
<i>Panicum antidotale</i> ..	Panicgrass	Seeds	1		1
<i>Panicum turgidum</i> ..	Panicgrass	Seeds	8	5	1
<i>Pennisetum typhoideum</i> ..	Bajra, a millet	Seeds	6		4
<i>Phaseolus aconitifolius</i> ..	Pulse	Seeds	1		3
<i>Phaseolus radiatus</i> ..	Pulse	Seeds			2
<i>Rhynchosia</i> sp. ..	a legume	Seeds			1
<i>Scirpus</i> sp. ..	Bullrush	Rhizome	2		
<i>Setaria verticillata</i> ..	Bristlegrass	Seeds	1		
<i>Solanum nigrum</i> ..	Black Nightshade	Fruit			1
<i>Sorghum</i> sp. ..	Sorghum	Seeds	4	3	1
<i>Tephrosia purpurea</i> ..	a legume	Seeds			3
<i>Tribulus</i> sp. ..		Seeds			1
<i>Triticum vulgare</i> ..	wheat	Seeds	2		1
<i>Zizyphus</i> sp. ..	Jujube	Fruit	4		
Unidentified ..	Grass	Blades	8	3	1
ANIMAL					
Hymenoptera ..	Ants	Whole	10	1	5
Isoptera ..	Termites—adult and larvae	Whole	10		1
Coleoptera ..	Beetles	Whole			3
Scarabidae ..	a beetle	Whole	4		2
Tenebrionidae ..	a beetle	Whole	5	1	
Hydrophyllidae ..	a beetle	Whole	5	1	
Carabidae ..	a beetle	Whole	5	1	
Elateridae ..	Click beetles	Whole	1		
Buprestidae ..	a beetle	Whole	1		
Curculionidae ..	Weevils	Whole	4		
Lepidoptera ..					
Noctuidae ..	Cutworms	Whole	3	1	
Orthoptera ..	Grasshoppers, Crickets	Whole	2		1
Homoptera ..	Bugs	Whole	2		
Diptera ..	Flies	Whole	1		
Solifugae ..		Whole	2		
Araneae ..	Spiders	Whole	1		
MISCELLANEOUS					
	Grit	Pieces	9	4	4
	Snail shells	Whole	1		
		Pieces			2
	Coal	Pieces			2
	Baked brick	Pieces			2

FOOD OF THE COMMON SANDGROUSE

Seven of the Common Sandgrouse examined were collected within 40 miles of Karachi (West Pakistan) and 40 were from western India, mostly from about Jodhpur, Delhi, and Poona.¹ This sample indicates that the food habits of this species are much different from those of the francolins previously examined. No insects were found, the diet, apparently, being restricted almost entirely to seeds.² Interestingly enough the majority of the seeds eaten were leguminous, and those species most abundantly taken (the *Indigoferae*) are extremely small seeds. In contrast to the francolins which take some cultivated grains and seeds of weeds often associated with agriculture, the sandgrouse prefers the seeds of wild plants. Thus the bird is in no way dependent upon agriculture and can therefore inhabit the more arid regions of India and Pakistan. The sandgrouse does not entirely ignore cultivated grains, however, as is shown by the presence of several cultivated seeds (*Phaseolus* and *Cyamopsis*) in minor quantities. The *Tephrosiae* which offer a fair-sized seed in contrast to the minute *Indigoferae* are also one of the favourite foods.³

Substantial quantities of seeds are consumed as can be seen by the following examples. In the crop of one bird, collected on March 12 near Karachi (Pakistan), there were about 5600 seeds of *Indigofera cordifolia*, 51 seeds of *Tephrosia tenuis*, 89 of *Indigofera uniflora*, and 9 of *Indigofera anabaptista*. The crop of another bird, collected on February 8 at Sambhar Lake, Rajasthan (India), contained about 10,000 seeds of *Indigofera linifolia*, 350 of *Crotalaria* sp., 1 of *Tephrosia strigosa*, 2 of *Panicum* sp., 1200 of *Gynandropsis gynandra*, 1 of *Tephrosia purpurea*, 5 of *Phaseolus radiatus*, and slightly over 100 seeds of species as yet unidentified.

The analysis of the foods eaten in the spring, summer, fall, and winter is presented in Table III.

RELATION OF THESE SPECIES TO AGRICULTURE

In considering the food eaten by any wild bird or mammal one of the questions frequently raised is its effect on agriculture. Misconceptions on this point are common and many game mammals and some birds are often killed in the mistaken notion (or the excuse) that they seriously damage farm crops.

¹ The authors gratefully acknowledge the considerable assistance of Fr. Joe Rodrigues in collecting sandgrouse for examination from the country east of Poona, his work being carried out with the aid of funds received by him from the Bombay Natural History Society out of a grant received by the Society from the Rockefeller Fund.

² Hume & Marshall (1880) found two insects in the crop of Common Sandgrouse.

³ Jerdon (1864) records the Common Sandgrouse as feeding on various hard seeds especially those of various *Alysicarpi*, *Desmodium*. Hume & Marshall (1880) say that 'no small seeds seem to come amiss'; Baker (1921) mentions 'hard seeds and grain'; and an anonymous author refers to the seeds of the common thistle as a favourite food.

TABLE III
Foods eaten by the Common Sandgrouse according to Season and number of Crops in which each was found

Foods	Parts eaten	Season			
		Spring	Summer	Fal 1	Winter
PLANT					
<i>Alysicarpus</i> sp. ..	Seeds	2	3	5	
<i>Amaranthus</i> sp. ..	Amaranth Seeds				1
<i>Crotalaria</i> sp. ..	Rattlewort Seeds	1			6
<i>Cyamopsis psoralioides</i> ..	Seeds				2
<i>Desmodium</i> sp. ..	Beggarweed Seeds				3
<i>Euphorbia</i> sp. ..	Spurge Seeds		1		
<i>Gynandropsis gynandra</i> ..	Seeds				5
<i>Heliotropium strigosum</i> ..	a heliotrope Seeds	2	6	7	4
<i>Indigofera anabaptista</i> ..	an indigo Seeds	1	3		
<i>Indigofera cordifolia</i> ..	an indigo Seeds	2	5	1	1
<i>Indigofera enneaphylla</i> ..	an indigo Seeds			2	2
<i>Indigofera linifolia</i> ..	an indigo Seeds	4	7	8	9
<i>Indigofera uniflora</i> ..	an indigo Seeds	1	4	6	
<i>Panicum antidotale</i> ..	Panicgrass Seeds				
<i>Panicum</i> sp. ..	Panicgrass Seeds				5
<i>Panicum turgidum</i> ..	Panicgrass Seeds			1	
<i>Phaseolus aconitifolius</i> ..	Pulse Seeds				1
<i>Phaseolus radiatus</i> ..	Pulse Seeds				4
<i>Tephrosia purpurea</i> ..	a legume Seeds	4	6	3	6
<i>Tephrosia</i> sp. ..	a legume Seeds			1	
<i>Tephrosia strigosa</i> ..	Seeds			5	10
<i>Tephrosia tenuis</i> ..	Hoary Pea Seeds	2	2		
<i>Unidentified</i> ..	Grass Blades	2	1		
MISCELLANEOUS ..	Grit	3	5	6	6

None of the three species here considered normally falls in this category. Farmers, generally, are glad to have or are indifferent to the presence of francolin and sandgrouse on their lands. Their good judgment in this respect is amply borne out by the results of this study. These birds do very little, if any, damage to farm crops and the good, in terms of weed seeds and insects consumed by them, is not to be overlooked. From the food habits as well as the sporting point of view they are among the most desirable game birds resident on the Indian subcontinent.

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